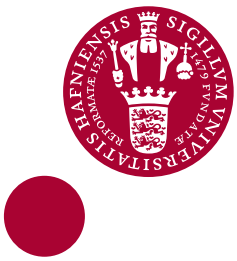

# The Catalhoyuk Microfauna

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# *Chapter 12*

# The Çatalhöyük Microfauna

Emma Jenkins & Lisa Yeomans

This chapter is concerned with microfauna from the second phase of excavations (2000–2008) at Çatalhöyük. Results from the 1960s excavations were published by Brothwell (1981), preliminary results from the first phase of excavation were published in Volume 4 of the 1995–1999 seasons reports (Jenkins 2005), and the full results from the first phase of renewed excavation were published in 2009 (Jenkins 2009b). Results from the BACH Area of the site were published separately (Jenkins 2012a).

The majority of the assemblage from the first phase of renewed excavation, directed by Hodder, is derived from only a few contexts, most of which are associated with human burials. The assemblage from the BACH area is from only one building, and its adjacent spaces (B.3 and Sp.85 and Sp.87). In contrast, the assemblage from the second phase of renewed excavations, discussed here, is from a greater array of units and, as a result, different research questions can be asked.

While past research was largely focused on trying to explain how vast quantities of microfauna became incorporated into human burials, this chapter is concerned with exploring how microfauna inhabited Çatalhöyük. By this we mean were there particular areas of the site that microfauna favoured? Are different species found in different spaces? And is there evidence that people took steps to try and manage the number of rodents on site or took measures to protect their grain stores from these pests? Past findings are perplexing.

Large numbers of small mammals, primarily house mice (*Mus musculus*), were incorporated into human burials; these small mammals appear to be derived from carnivore scats. This is evident from the presence of corrosion or digestion on certain elements caused by the stomach acid of the predator (Andrews 1990). In addition, gnaw marks and tooth puncture marks were found indicating that the predator must have been a carnivore rather than an owl or diurnal bird of prey.

The taphonomic history of these assemblages is unclear, but it has been proposed by Jenkins (2009b) that these scats may have been deliberately placed into the burials by humans. As a result, it is unclear if these mice were living in or around the site, or if the scats in which they were incorporated were brought from elsewhere. Previous work (Jenkins 2005; 2009b; 2012a), however, has demonstrated that it is not only the microfauna from the burials that were derived from carnivore scats but that microfauna found in other areas of the site were also eaten by carnivores.

Most excavation units have low numbers of microfauna, with house mice being the dominant taxa. It is not surprising that mice were present because Çatalhöyük, with its abundant scavenging opportunities and lack of competition from other species, would have been a haven for them. The propensity of mice to decimate stored food supplies would presumably have been of great concern to the human inhabitants of the site. A more modern example of this problem can be found in the statistics of the World Health Organization who in 1979 estimated that thirty-three million tons of cereal was lost to rodents worldwide (Meyer 1994, 276).

The results from Çatalhöyük to date suggest that house mice were living in or around the site and that an unknown species of carnivore was predating upon them. We aim to explore this further in the present chapter. By analyzing samples from a greater array of excavation units than in the past and whose taphonomic history is less ambiguous than the large concentrations of microfauna that were previously studied, we aim to increase our understanding of how microfauna inhabited Çatalhöyük and how this affected its human occupants.

## Materials and method

### *Recovery and sorting*

In total 3,237 identifiable specimens were analyzed from 220 units. These were recovered in the heavy residue as part of the flotation process. Heavy residue is retrieved in a 1mm mesh and then sieved through a series of 4mm, 2mm and 1mm stacking sieves. This is then sorted by local women, most of who have been working at the site for many years, thereby ensuring consistency. The amount of heavy residue sorted varies. One hundred per cent of the 4mm fraction is sorted, but the amount sorted for the 2mm and 1mm fractions varies from 100 per cent to 6.25 per cent according to the amount of heavy residue produced. When concentrations are discussed in detail, Table 12.1 shows the per cent sorted for the 1mm and 2mm fractions. When NISP per liter is calculated, the 1mm and 2mm fractions are multiplied up to represent the number one would expect if 100 per cent of the sample had been available for analysis.

Microfauna is sorted for identifiable elements on site by

| Unit | Sample | Flot Number | 4 Weight | 4 % sorted | 2 Weight | 2 % sorted | 1 Weight | 1 % sorted | Feature | Year | Flot Volume | Interpretive category | NISP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10284 | 1 | 5962 | 18.61 | 100 | 0.03 | 50 | 0.05 | 25 | 2003 | 2005 | 40 | house fill | 2 |
| 10284 | 6 | 5961 | 126 | 100 | 0.6 | 50 | 0.16 | 25 | 2003 | 2005 | 23 | house fill | 17 |
| 10292 | 2 | 5975 | 220 | 100 | 1.55 | 50 | 0.33 | 25 | 2003 | 2005 | 25 | cluster of antler, stone pebbles and other stone fragments | 81 |
| 16756 | 2 | 8380 | 210 | 100 | 0.18 | 12.5 | 0.12 | 6.25 | 2003 | 2008 | 190 | fill of storage bin | 2 |
| 16757 | 2 | 8412 | 0.28 | 100 | 0.02 | 100 | 0.02 | 100 | 2003 | 2008 | 4 | fill of storage bin | 0 |
| **Total F. 2003** | | | **574.9** | | **2.4** | | **0.7** | | | | **282** | | **102** |
| 11904 | 1 | 6053 | 95.43 | 100 | 0.62 | 25 | 0.02 | 12.5 | 2004 | 2005 | 26 | bin fill | 1 |
| 11907 | 2 | 6064 | 122 | 100 | 0.6 | 25 | 0.16 | 12.5 | 2004 | 2005 | 26 | bin fill | 52 |
| 11907 | 5 | 6112 | 88.22 | 100 | 0.8 | 50 | 0.32 | 12.5 | 2004 | 2005 | 43 | bin fill | 42 |
| 11911 | 2 | 6051 | 15.59 | 100 | 0.71 | 100 | 0.22 | 100 | 2004 | 2005 | 1.5 | cluster of peas | 22 |
| 11911 | 4 | 6056 | 2.32 | 100 | 0.38 | 100 | 0.12 | 100 | 2004 | 2005 | 0.5 | cluster of peas | 21 |
| 11923 | 1 | 6078 | 38.85 | 100 | 1.83 | 100 | 0.14 | 25 | 2004 | 2005 | 15 | cluster of macrofauna | 38 |
| **Total F. 2004** | | | **362.4** | | **4.9** | | **1.0** | | | | **112** | | **176** |
| 11936 | 2 | 6158 | 18.88 | 100 | 0.6 | 50 | 0.22 | 25 | 2005 | 2005 | 35 | bin fill | 1 |
| 11958 | 2 | 6181 | 18.36 | 100 | 1.01 | 50 | 0.24 | 12.5 | 2005 | 2005 | 26 | bin fill | 6 |
| **Total F. 2005** | | | **37.2** | | **1.6** | | **0.5** | | | | **61** | | **7** |
| 14429 | 2 | 8201 | 73.4 | 100 | 2.85 | 50 | 0.34 | 25 | 4000 | 2008 | 52 | burial fill | N/A |
| 14429 | 5 | 8227 | 106 | 100 | 2.58 | 50 | 0.42 | 25 | 4000 | 2008 | 86 | burial fill | 109 |
| 14429 | 9 | 7885 | 20.55 | 100 | 0.22 | 100 | 0.05 | 25 | 4000 | 2008 | 19 | burial fill | 8 |
| 14429 | 10 | 7882 | 17.03 | 100 | 0.51 | 100 | 0.06 | 100 | 4000 | 2008 | 6 | burial fill | 10 |
| 14429 | 11 | 8207 | 86.2 | 100 | 0.6 | 50 | 0.08 | 25 | 4000 | 2008 | 50 | burial fill | 20 |
| **Total F. 4000** | | | **303.2** | | **6.8** | | **1.0** | | | | **213** | | **147** |

gray = unanalyzed

**Table 12.1.** *Units discussed in text with sample number, flot number, percentage of fractions sampled, interpretive category and NISP*

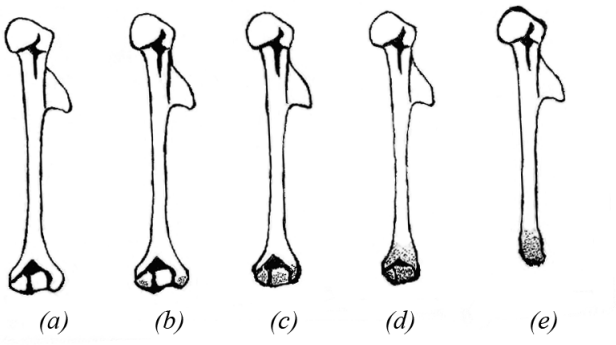


**Figure 12.1.** *Humerus digestion categories: (a) undigested humerus; (b) humerus with light digestion - slight pitting caused by acid corrosion can be seen on the epicondyles; (c) humerus with moderate digestion - more extensive pitting is found on the epicondyles and this affects a larger surface area of the distal end; (d) humerus with heavy digestion - the edges of the distal end are corroded and the pitting extends up the shaft of the element; (e) humerus with extreme digestion - the distal end is almost unrecognizable due to the extent of the corrosion.*

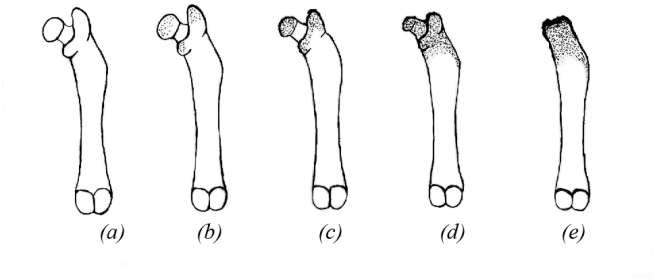


**Figure 12.2.** *Femur digestion categories: (a) undigested femur; (b) lightly digested femur with slight pitting from acid corrosion on the femoral head and the greater and lesser trochanters; (c) moderately digested femur - the pitting is more severe and extensive and the outline of the femoral head has been corroded slightly; (d) heavily digested femur - pitting has affected the whole of the proximal end and the edges of the femoral head and the greater and lesser trochanters have been corroded; (e) femur with extreme digestion -the proximal end is unrecognizable due to the extent of the corrosion, which has completely destroyed the femoral head and the greater and lesser trochanters and extends down to the third trochanter.*

Jenkins and then exported to the UK for analysis. No record is kept of the number of unidentifiable fragments. This means that some taphonomic information is limited, but this is a necessary compromise due to the working regime at the site. The unidentifiable fragments include both microfauna and a large amount of fragmentary macro fauna and, even when it is possible to differentiate microfauna from macrofauna, on-site time constraints do not allow for these to be analyzed and counted. Furthermore, only a selection of microfauna can be exported to the UK because the Turkish authorities do not generally permit the export of fauna, although they make an exception for microfauna in small quantities. In response to this, a judgment was made to compromise our understanding of some aspects of the taphonomy in order to have a greater proportion of identifiable elements and to gain information in other areas.

***Taxonomic and taphonomic analysis***

Specimens were analyzed using a *Brunel BRS* microscope with a magnification of x5.5 to x50. Species identification was restricted to cranial elements and made using the reference collection of Jenkins and specimens from the faunal collection of Bournemouth University and the Harrison Institute, Kent. Specimens of the sub-species *Mus musculus* (house mouse) were identified following the methodology developed by Harrison and Bates (1991, 250). Digestion (corrosion caused by the stomach acid of predators) was recorded for the following elements: loose teeth, skulls, maxillae, mandibles, distal humeri and proximal femora. Digestion was recorded as light, moderate, heavy or extreme following the methodology of Andrews (1990) and Fernandez-Jalvo & Andrews (1990). Digestion categories were developed by Jenkins (2003) for post-crania and are shown in Figures 12.1 and 12.2. Digestion categories for incisors and microtine molars followed Fernandez-Jalvo & Andrews (1991, 413). Figure 12.3 shows the digestion categories used for murid molars created by Jenkins (2009b). Due to low sample numbers, digestion is calculated for the assemblage as a whole and is meant only as a general indication of the level of predation on site. This is because combining multiple samples is problematic due to the fact that different samples will have had different taphonomic pathways, with some representing natural deaths rather than deaths by predation. The diameter of the puncture marks was measured using a graticule set into the eye piece of the microscope. Recording of cranial breakage for murids and microtines and for post-crania follows Andrews (1990).

***Quantification***

NISP (number of identified specimens) was calculated for each unit. If the combined NISP for micromammals from all units within a space or building was greater than 100, body-part representation of the skeletal elements present was analyzed. This limited the analysis of body part representation to: Sp.279, an external area with a sequence of middens; B.44 located in the South Area; B.49 in the 4040 Area and consisting of a main room (Sp.100) and a smaller side room (Sp.334); and B.52 from the same area and consisting of a large central room (Sp.94) with Sp.93 to the north, Sp.91 and Sp.92 to the east. The minimum number of elements (MNE)

| All 4040 and South Area deposits from 2002 | |
|---|---|
| Digestion of incisors | |
| Loose incisor | Number |
| No digestion | 230 |
| Light digestion | 9 |
| Moderate digestion | 5 |
| Heavy digestion | 1 |
| Incisor in jaw | Number |
| no digestion | 17 |
| Digestion of molars | |
| Vole molars (all) | Number |
| No digestion | 7 |
| Light digestion | 1 |
| Loose non-vole molars | Number |
| No digestion | 66 |
| Light digestion | 2 |
| Heavy digestion | 1 |
| non-vole molars in jaw | Number |
| No digestion | 295 |
| Moderate digestion | 2 |
| Digestion of micromammal distal humeri | |
| Distal humerus | Number |
| No digestion | 39 |
| Light digestion | 3 |
| Digestion of micromammal proximal femora | |
| Proximal femur | Number |
| No digestion | 66 |
| Digested? | 1 |
| Light digestion | 1 |
| Moderate digestion | 5 |

**Table 12.2.** *Digestion by category for incisors, vole molars and post-crania for the entire assemblage.*

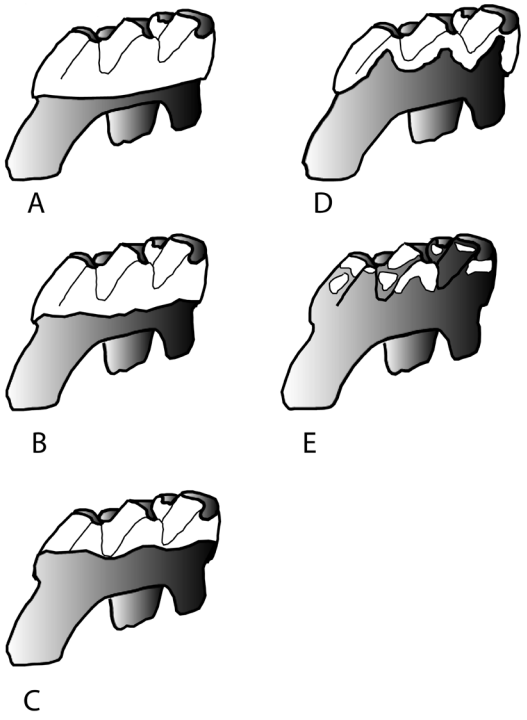


**Figure 12.3.** *Digestion categories for murid molars: (a) Undigested murid molar - enamel is shown in white, dentine in gray; (b) light digestion - the junction between enamel and dentine has a 'wavy' appearance and is less defined than in the undigested molar; (c) moderate digestion - more of the enamel is digested and the enamel/dentine junction is found higher up the crown of the tooth; (d) heavy digestion - a limited amount of enamel remains on occlusal surfaces. (e) extreme digestion - enamel is nearly completely absent from the tooth and in some instances corrosion of the dentine is visible.*

was calculated for the major long bones, astragalus, calcaneus and teeth, which provides the minimum number of individuals (MNI) within each building or space. Portion of bone present was used in the calculation of the MNE values but side was not. The representation of each element was then calculated as a proportion of the expected representation given the MNI value, thereby correcting for differential numbers of elements within a complete skeleton. The same method of analysis was conducted for features within buildings that produced over 100 micromammal bones, giving MNI values and body-part representation of the micromammal bones found in bins F.2003 and F.2004 both in Sp.93 of B.52 and in the burial F.4000 in B.49.

Density of the general category 'microfauna' through time was assessed by comparing the number of elements per level for middens from the South Area. This was done by taking the total number of elements recovered in the 4mm and 2mm fractions by level and dividing the number by the total volume of the samples from which the bone was recovered. By comparing only middens, our intention was to eliminate, as much as possible, contextual bias that might contribute to fluctuations in densities of microfauna. As stated above, in order to make the comparison consistent despite variations in sampling sizes for the 2mm fraction, the NISP was multiplied up to give an approximation of how many elements would have been found if 100 per cent of the assemblage had been analyzed. For example, if only 25 per cent of the sample was analyzed this was multiplied by four.

We conducted a similar analysis to determine the number

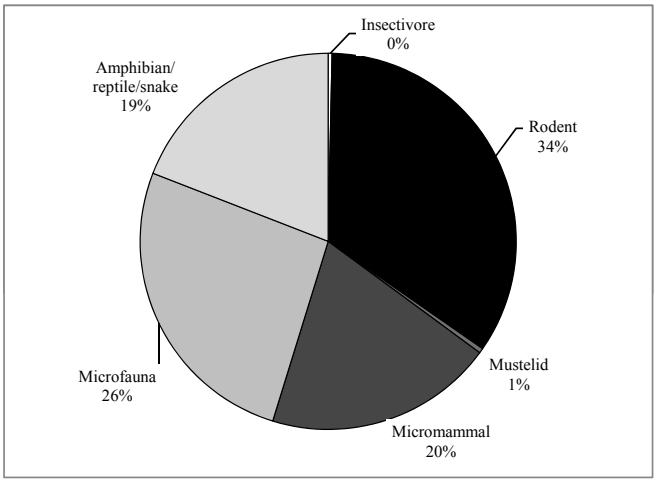


**Figure 12.4.** *Taxonomic composition of the whole assemblage by NISP.*

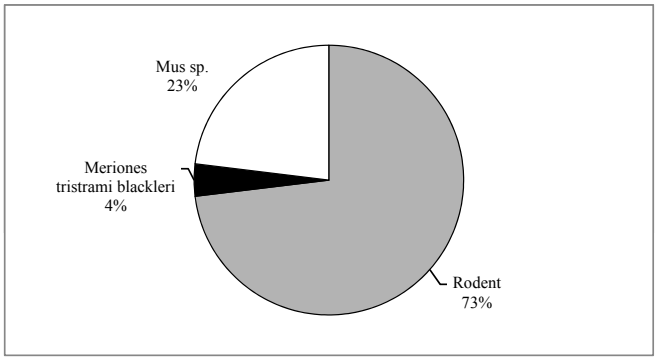


**Figure 12.6.** *Taxonomic composition of elements that could be identified to order or beyond from Bin F.2003 by NISP.*

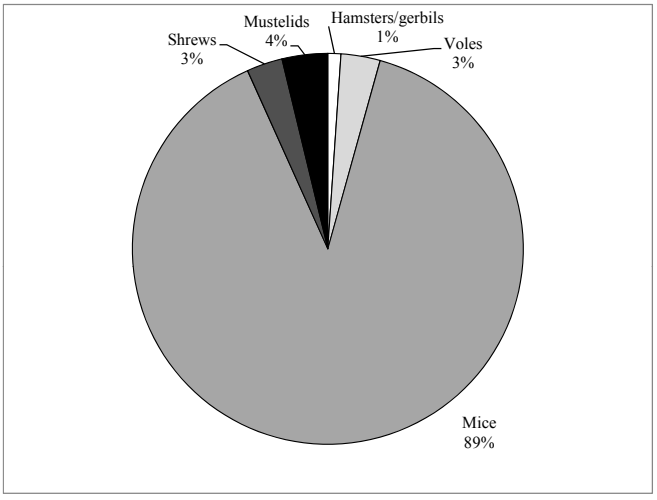


**Figure 12.5.** *Taxonomic composition of the whole assemblage, by NISP, with microfauna and micromammals excluded.*

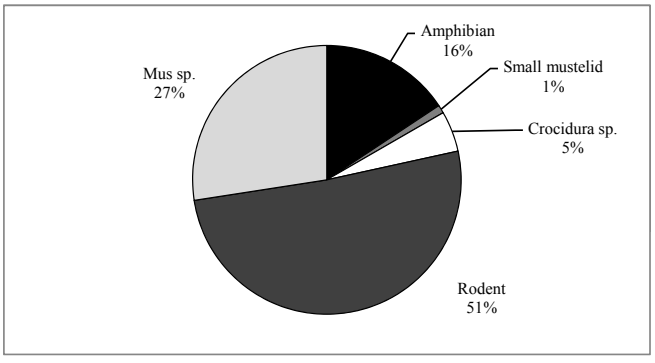


**Figure 12.7.** *Taxonomic composition of the sample from Bin F.2004 by NISP.*

of murines (old world rats and mice) per liter of sample. We believe that looking at the general category 'murine' gives the most accurate estimation of the number of house mice on the site. This is because Çatalhöyük does not have any rats, and the only species of mice found at the site are house mice (*Mus musculus*). We therefore assume that all of the mice remains found represent the commensal house mouse rather than *Mus macedonicus*. In this analysis, we included the 1mm fraction because murine remains, particularly teeth, are very small and are often recovered in the 1mm fraction.

## Results

### *NISP and species composition*

*Whole assemblage*

Figure 12.4 shows the breakdown of taxa by NISP according to general groupings. This breakdown included elements that were so fragmentary that they could not be identified beyond the generic term 'microfauna'. From this analysis, it is apparent that micromammals and rodents dominate. Amphibian/reptiles/snake account for 19 per cent of the total which compares to: 15.9 per cent for the BACH area (Jenkins 2012a); 1.3 per cent for the assemblage from the first phase of renewed excavation (Jenkins 2009b); and none reported for the assemblage from the human burial (Brothwell 1981). The large difference between this assemblage and the BACH assemblage, as compared to the assemblage from the first phase of excavations, is probably attributable to the differences in the method of accumulation. While a large proportion of the assemblage from the first phase of excavation was derived from carnivore scats, this assemblage and the BACH assemblage appear to represent a mixed taphonomic pathway which includes elements with digestion and puncture marks that are clearly derived from carnivore scats, but also include some that have no surface modifications and seem to represent indi-

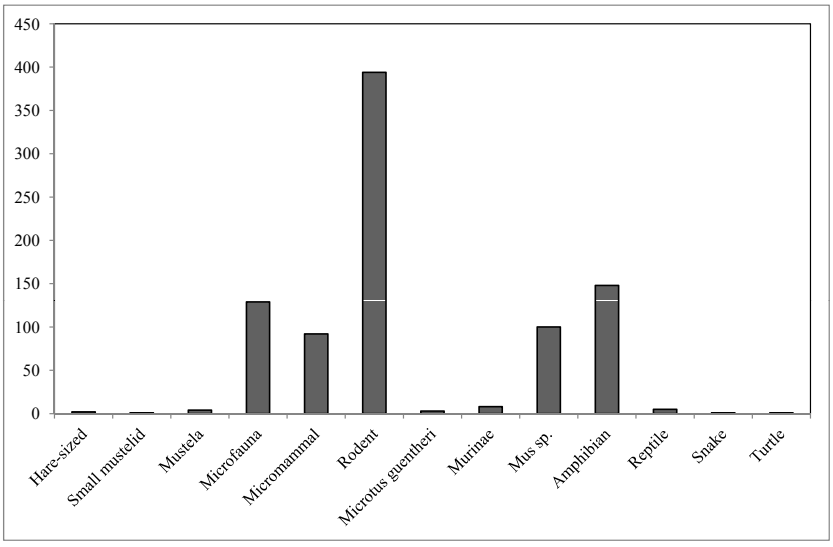


**Figure 12.8.** *Taxonomic composition of the sample from Building 49 by NISP.*

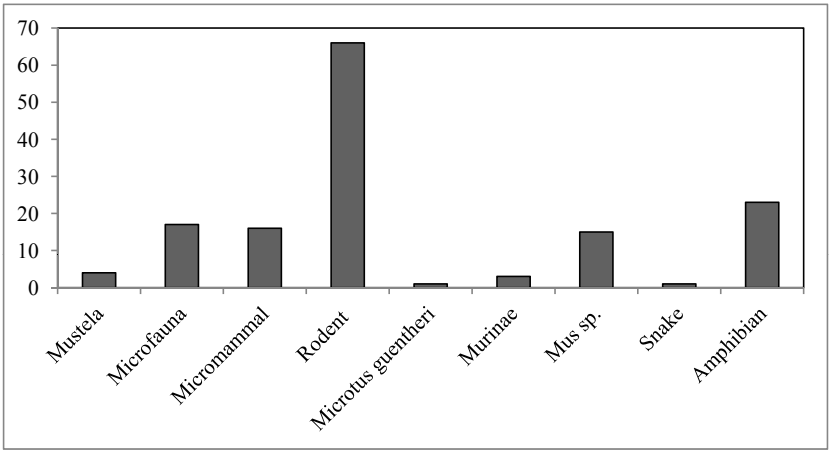


**Figure 12.9.** *Taxonomic composition of the sample from F.4000 by NISP.*

viduals whose death was not caused by predation. As a result, there is a reduced predator-selector bias in this assemblage and the BACH assemblage, which probably provides a more accurate representation of the number of amphibians/reptiles/snakes at the site.

When the more general groups are discounted, and the species composition examined at a closer level, with microfauna and micromammal omitted and rodents broken down into more specific groups (see Fig. 12.5), it is clear that the most dominant taxa, with 89 per cent of the total, are mice, including murines, *Mus* sp. and *Mus musculus.* This is a lower percentage than found previously whereby, of elements that could be identified to genus level or beyond, 95.9 per cent of them were *Mus* sp. or *Mus musculus*; if the general category murine is also included with those that could be identified to genus level, the figure rises to 96.2 per cent. It is likely that the elements that can only be identified to murine are also *Mus* sp. because, as stated above, no other genus of mouse has ever been found at Çatalhöyük and all of the maxillae that can be identified to species level are *Mus musculus*.

*Internal versus external areas*

One of the questions we were interested in exploring is whether there was a difference in the microfaunal taxa found in internal areas compared to external ones. In order to address this, we compared the NISP of amphibian elements to micromammal elements in external and internal units. Results show that while amphibians are equally distributed in internal and external deposits (49 per cent are found in external deposits as opposed to 51 per cent in internal), 81 per cent of micromammals are in internal units.

In order to analyze this more fully, we compared the number of murines to non-murines from the internal and external areas. The rationale behind this analysis is to determine if the majority of rodents found in the internal areas were house mice. Murines were chosen as the category of analysis because it is assumed that they are largely comprised of *Mus* sp., which in turn is comprised of *Mus musculus*. This assumption is made based on our knowledge of the species composition of the assemblage analyzed to date whereby, as stated above, 95.9 per cent of taxa that can be identified to genus level or above are *Mus* sp. or *Mus musculus,* and no other species of murine has ever been found at Çatalhöyük. Therefore, we are assuming that those elements that could only be identified as murine or *Mus* sp. are in fact house mice (*Mus musculus*). The results of this comparison demonstrate that while 97 per cent of elements from internal deposits are murine, only 85.1 per cent are murines from external areas. This is because while murines are abundant in both the internal and external deposits, other species of rodent are mainly found in the external areas.

*Building 52*

Microfaunal samples with a NISP of over 100 were analyzed from two features in B.52, one from bin F.2003 and the other from bin F.2004, both in Sp.93. Storage bin F.2003 consisted of seven units which produced a NISP of 102 (see Table 12.1 for details of samples, volumes and sample size). Species composition of elements which can be identified to order or

| Taxa | Element | Digestion | Gnawing | Tooth puncture marks |
|---|---|---|---|---|
| Micromammal | vertebra | | | multiple |
| Rodent | incisor | moderate | | |
| Rodent | maxilla | | moderate | multiple |
| Rodent | maxilla | | moderate | |
| Rodent | humerus | | moderate | |
| Rodent | tibia | | light | |
| Mus sp. | incisor | | light | single |
| Mus sp. | molar | | | single |

**Table 12.3.** *Digestion for F.4000.*

beyond for F.2003 is shown in Figure 12.6; from this it is clear that the majority of elements, mainly incisors and post-crania, were identified as rodent. When more specific identification was possible, however, the majority of elements identified were *Mus* sp. The other storage bin analyzed from B.52 which had a NISP of 174 was F.2004. This sample was derived from 112 liters of soil from four excavation units. One hundred per cent of available microfauna was sampled (see Table 12.1 for a list of units and heavy residue sampling). As illustrated in Figure 12.7, rodents are again the dominant group (51 per cent). In this instance a greater array of taxa was found, including amphibians, low levels of *Crocidura* sp. and small mustelid elements. In addition to these two concentrations, microfauna was also recovered from other areas of B.52, (NISP of 14 from bin F.2002; six from bin F. 2005; seven from basket F.2040; 14 from post scar F.2178; and 166 from units not designated to a feature). This comes to a total NISP for the microfauna analyzed from B.52 of 472.

*Building 49*

B.49 is located in the 4040 Area and consisted of 515 excavation units. Of these, 40 were analyzed for microfauna and produced a NISP of 888, including the general category of microfauna. When this general category is excluded, the NISP is 759. Figure 12.8 shows how this NISP breaks down by taxon and it is evident that there are a large number of non-mammalian taxa. In addition, it is also clear that of the rodents, *Mus* sp. is by far the most abundant genus.

A burial found within B.49 containing a young woman and baby (F.4000) produced a microfaunal assemblage with a NISP of 146. This was based on the analysis of 161 liters of soil out of 213 liters floated (see Table 12.1 for details on the per cent of 2mm and 1mm analyzed with weights). The breakdown of this assemblage by taxon is shown in Figure 12.9 and demonstrates that rodents are the dominant taxon, although snake and weasel (*Mustela nivalis*) remains were also found.

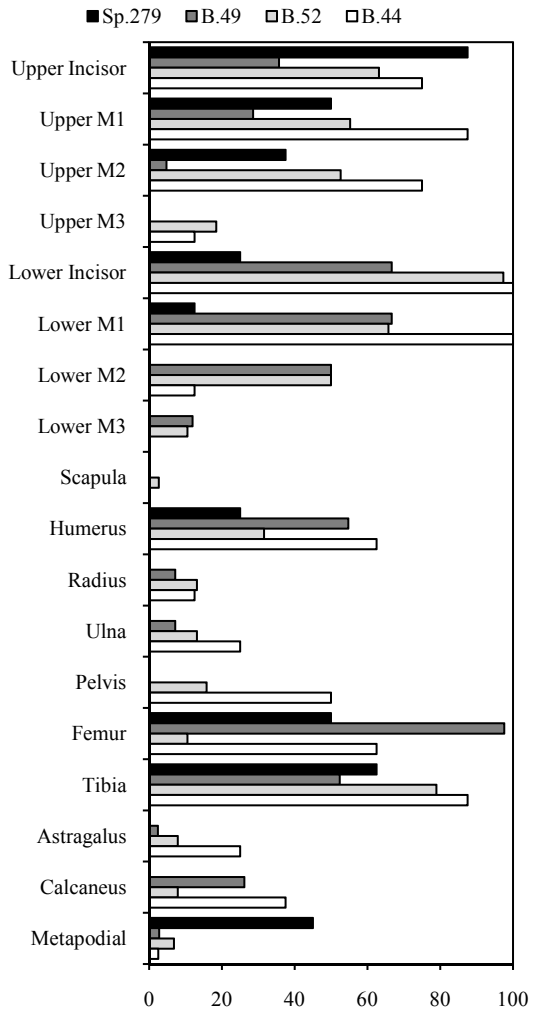


**Figure 12.10.** *Body part distribution for buildings and spaces with a NISP of over 100.*

***Taphonomy***

*Predator induced modifications*

Table 12.2 shows the digestion by category for incisors, vole molars and post-crania. There were no digested murid molars. In total, 5.7 per cent of incisors and 1.6 per cent of microtine molars were digested. This is a low level of digestion, and while only being a general indication due to the combining of multiple samples, this result is in accord with results from the first phase of excavation and from the BACH area. In contrast to this, the post-crania show higher levels of digestion, with 7.1 per cent of distal humeri and 9.6 per cent of proximal femora being digested. Again, in accord with earlier results, elements were found that had evidence of gnawing and/or puncture marks. In total, 0.6 per cent of elements have puncture marks, and these have a mean size of 0.32 x 0.35 mm. When there are multiple puncture marks on the same

| Feature | Unburnt | Burnt | % Burnt | Undigested | Digested | % Digested |
|---|---|---|---|---|---|---|
| no feature | 89 | 23 | 20.5 | 107 | 5 | 4.5 |
| 2002 | 15 | 1 | 6.3 | 16 | 0 | 0.0 |
| 2003 | 27 | 75 | 73.5 | 102 | 0 | 0.0 |
| 2004 | 24 | 149 | 86.1 | 172 | 1 | 0.6 |
| 2005 | 5 | 2 | 28.6 | 6 | 1 | 14.3 |
| 2040 | 0 | 9 | 100.0 | 9 | 0 | 0.0 |
| 2178 | 1 | 14 | 93.3 | 15 | 0 | 0.0 |

**Table 12.4.** *Percent burning by unit for Building 52.*

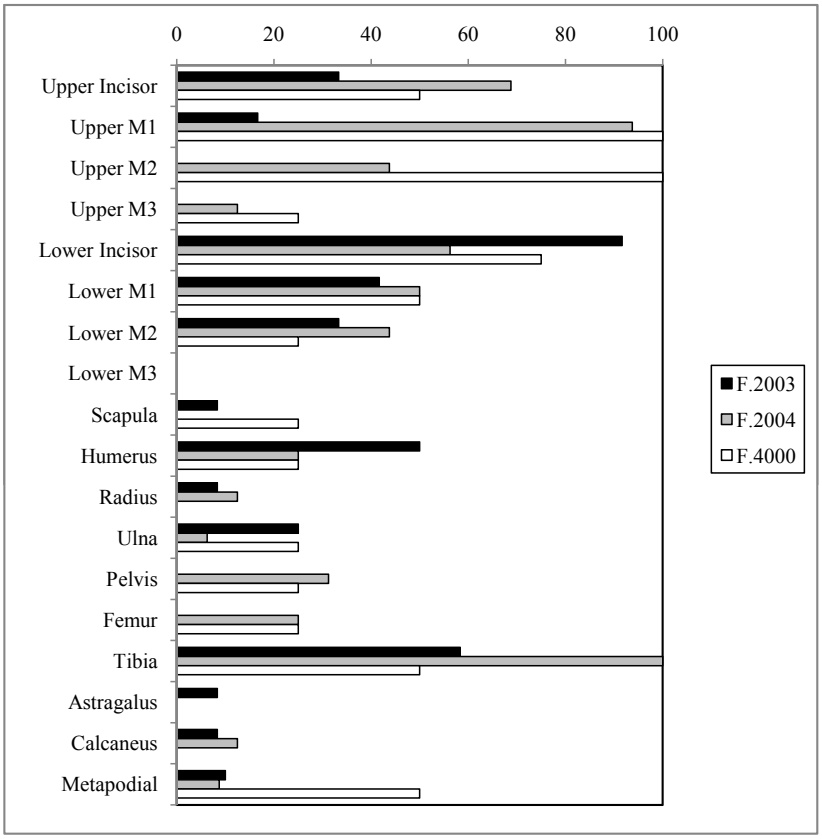


**Figure 12.11.** *Body part distribution for features with a NISP of over 100.*

element, the mean distance between them is 0.92 mm. As past analyses have demonstrated that microfauna in human burials are derived from carnivores scats, the taphonomy of the sample from F.4000 was examined in detail and the elements with carnivore modifications are listed in Table 12.3. While it is clear from this table that there are a few elements that show predator-induced taphonomic modifications, it is noteworthy that these were found in a human burial in keeping with the earlier discoveries (Jenkins 2009b).

Burning was found on 54.9 per cent of elements, with Sp.93, Sp.94 and Sp.336 having the highest levels of burning. Sp.93 and Sp.94 are within B.52, while Sp.336 is in B.77; both of these buildings were abandoned after a fire. The elements from these samples also have minimal digestion or puncture marks, indicating that these elements represent individuals that died natural deaths, or death by burning rather than death by predation. Table 12.4 shows the per cent burning by unit for B.52 and demonstrates that the units with the highest percentages of burnt elements are: (10292), (10299), (11907), (11911), (11923), (11970) and (11936).

***Body parts***

Body part distribution for buildings and spaces with a NISP of over 100 is shown in Figure 12.10, and for the features that have a NISP of over 100 in Figure 12.11. Results demonstrate that cranial elements are relatively well-represented, while fore limbs, with the exception of the sample from F.2003 in B.52, are generally under-represented in comparison to hind limbs. This was also found in previous analysis, including that conducted by Brothwell (1981), although in past analysis this pattern was more evident than in the current study. This pattern is likely to be caused by the feeding practices of the carnivores that were primarily responsible for accumulating the large assemblages previously found, although this pattern of skeletal element distribution is not typical for carnivore assemblages, which usually have fewer hind limbs compared to fore limbs (Andrews 1990, 50). An explanation for why this pattern is less pronounced in the current analysis could be that the assemblage is mixed, with some microfauna representing natural deaths and others deriving from carnivore scats.

***Density through time***

Figure 12.12 shows the density of microfauna recovered in the 4mm and 2mm fractions from the South Area middens by level. From this it is apparent that Level South Q has the greatest density of microfauna, but this figure is inflated by (17099), which has a density per liter of 37; without this unit, the density would be 0.82 for Level South Q. The second densest level is Level South G, while the remaining levels all have less than one element per liter. Figure 12.13 shows the density of murines in all fractions from the South Area by

Level and demonstrates that Level South G has the greatest density of murine elements. It is also clear, however, that the density is low throughout time, with all levels having, on average, less than one element per liter of soil sampled.

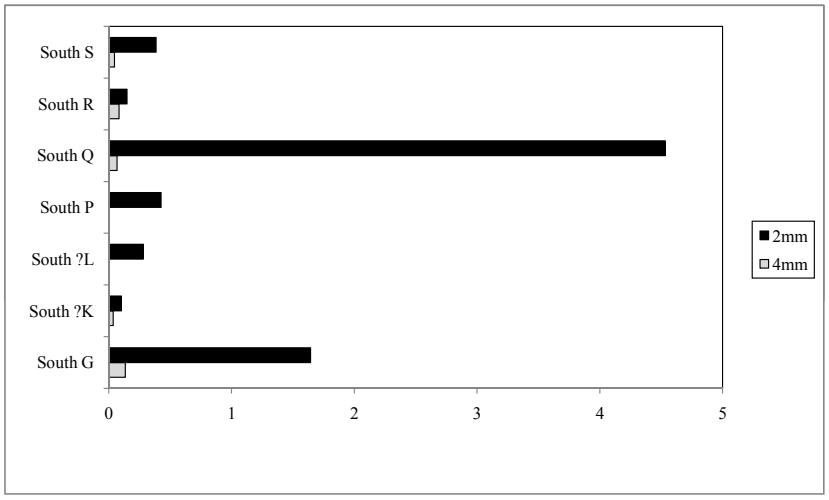


**Figure 12.12.** *The NISP per litre of microfauna from the south area middens by phase (N.B. NISP has been adjusted for the 2mm fraction to provide an estimation of the NISP if 100% of the sample had been available for analysis).*

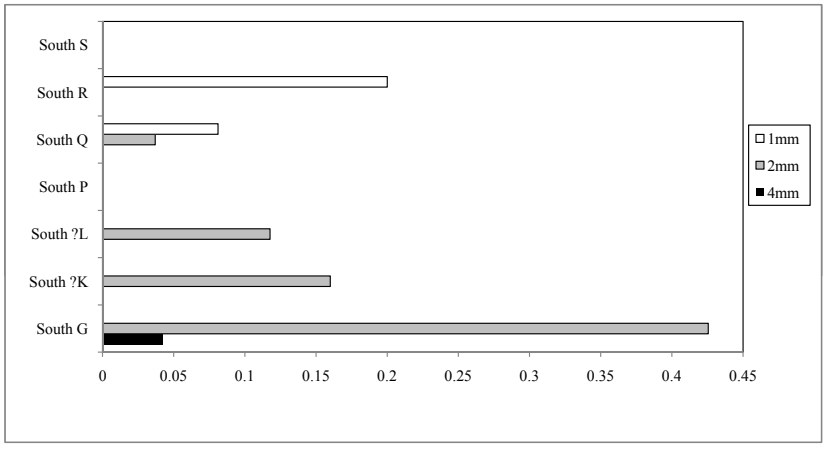


**Figure 12.13.** *The NISP per litre of murines,* Mus *sp. and* M. musculus *from the south area middens by phase (N.B. NISP has been adjusted for the 2mm and 1mm fraction to provide an estimation of the NISP if 100% of the sample had been available for analysis).*

## Discussion

### *Predators at Çatalhöyük*

Results from the analysis of the microfaunal assemblage from the second phase of excavations at Çatalhöyük demonstrate that it represents a mixed assemblage comprised of individuals who died from a variety of causes, i.e. natural death, death by burning or death by predation. This is in contrast to the majority of the assemblage analyzed from the first phase of excavations, which was comprised of individuals that appear to have come from carnivore scats. What is also apparent, however, is that those individuals who died as a result of predation in the assemblage discussed here, seem to have been victims of the same species of predator as those from the assemblage from the first phase of excavations and from the BACH assemblage. Of particular note for this assemblage is burial F.4000 which, like some of the concentrations from the first phase of excavations, contained microfauna from carnivore scats.

Unfortunately, as stated above, it has not been possible to identify the predator responsible, but the taphonomy and species composition of the various assemblages are consistent with each other, suggesting they are accumulated by the same species of predator. They are typified by being predominantly comprised of mice, having low levels of digestion and breakage, and small but distinctive puncture marks. In addition, digestion and puncture marks are more frequently found on the distal end of the humeri rather than on the proximal end. Furthermore, when the body part representation for the Mellaart assemblage is plotted (Brothwell 1981), it also matches the assemblages from the recent excavations (Jenkins 2007; 2009b; 2012b); the cranial elements are better represented than the post-cranial elements, and the hind limbs are better represented than the fore limbs.

However, these patterns of digestion and breakage do not match those for modern carnivores. Past analysis (Jenkins 2009b) has found that the puncture marks are small, with a mean width of 0.43 mm ($n$=255, SD 0.19), while the average for the current analysis is 0.37 mm ($n$=37, SD 0.13). It is of course possible for a large carnivore to make a small puncture mark by using only the tip of the tooth to pierce the bone, but one would expect at least some of the puncture marks to be larger if this was the case. This suggests that the predator was small, but small predators such as reptiles and mustelids cause very high levels of breakage and digestion to the bones of their prey. For example, although snakes can swallow their prey whole, their scats are largely devoid of bone, such is the severity of their digestive systems (Blain & Campbell 1942; Fitch & Twining 1946; Nesbitt-Evans & Andrews 1989; An-

**Figure 12.14.** *A reconstruction of a Sp.93, B.52 storage bin with mouse infestation (Illustration by Mesa Schumacher).*

drews 1990). Larger species of mammalian carnivores such as felids and canids, however, also cause much higher levels of digestion and breakage than is found in the Çatalhöyük assemblages (Andrews & Nesbit-Evans 1983; Andrews 1990).

It is clear from the above discussion that further research is required to identify the predator. Feeding experiments could help explore whether there are variables which could have caused such differences in the taphonomy of the Çatalhöyük assemblages when compared to known predator scat assemblages.

For example, it is possible that the Çatalhöyük elements are less broken than those from modern small carnivore assemblages because the elements in these samples are from small microfaunal species, such as mice, rather than larger microfaunal species such as voles. As a result, it may not have been necessary for the carnivores to chew these remains thoroughly before consumption. In addition, the majority of the teeth in the Çatalhöyük assemblages are murid (mainly mice), and, due to their morphology, murid molars are less susceptible to digestion than are microtine (vole) molars (Williams 2001) Finally, the level of digestion in the microfauna may be lower than observed in modern carnivore assemblages if prey were abundant. This is because the rate of digestion is directly proportional to the amount of time elements spend in the predator's stomach; therefore, if prey is readily available, the carnivore will eat more, which speeds up the rate of digestion (Andrews & Nesbit-Evans 1983).

Results from the density of microfauna per liter of soil indicate that most levels have modest amounts of microfauna (less than one element per liter). It is difficult, however, to estimate how this figure translates to the entire site, which must be comprised of millions of liters of soil. We have also found large concentrations of microfauna from scat assemblages, however, including one from the first phase of excavations which appear to have been an *in situ* accumulation (2091) rather than one in which the scats had been deliberately moved by humans. This suggests that there were enough mice in the vicinity of Çatalhöyük to sustain these carnivores.

Having microfauna which appear to have died from natural causes or burning is very useful because it gives us a greater insight into the nature of the microfaunal occupation of Çatalhöyük, as this assemblage is more likely to represent *in situ* deaths. This is not the case for the scat concentrations which could have been brought from elsewhere. Of particular interest are the samples from B.52, which is one of two burnt buildings. As a result of the burning, this building has remarkable levels of organic preservation and, as such, provides information about food storage and the use of space within a structure. Botanical evidence recovered from the bins, floor and infill of Sp.93 indicates that the bins were used to store cereal grains, almonds, peas, wild mustard and a variety of wild seeds (see Bogaard 2009; Twiss 2009; Chapter 7). The pea concentration and the surrounding deposits also contained charred mouse pellets (Twiss *et al.* 2009). As discussed in the results section of this chapter, the majority of microfaunal elements display no signs of digestion, suggesting that these individuals died natural deaths or were burnt by the fire. Figure 12.14 is a reconstruction of a Sp.93, B.52 storage bin with a mouse infestation.

This occurrence of rodents, particularly mice, within the units associated with food storage is unsurprising. Çatalhöyük, with its excellent scavenging opportunities for stored food and refuse, would have been a haven for house mice. The site would also have provided shelter, with the walls and roofs of houses being ideal hideaways or nesting areas. In addition, it would have minimized competition with other non-commensal small mammals, as evidenced in our analysis of the percentage of taxa in internal as opposed to external areas; this demonstrates that the non-commensal micromammals were more likely to be found in external areas. The discovery of *in situ* dead rodents and pellets in the storage bins of Sp.93 provides the first direct evidence at Çatalhöyük of rodents infesting food storage areas. This highlights the challenge of storing food in an early agricultural community, where a small food surplus would have been essential insurance against hunger. The creation of purpose-built clay storage bins would have partly helped to address this problem and it is interesting that the four storage bins found in Sp.93 were all lined with plaster which may have been used not only to protect the stored food from damp but also from mice. While other plaster-lined bins have been found, they are not typical at Çatalhöyük. In addition, a thick layer of whitish clay was found in the upper part of the bin (F.2005), which may have been used as a plug or lid in an attempt to prevent mice from getting inside. Despite these measures, mice infestation would still have been a problem because rodents are tenacious and agile with an extraordinary ability to jump,

chew and squeeze through small spaces.

When the NISP per unit is examined for bins F.2003 and F.2004, the results are interesting. In bin F.2003, the greatest NISP is found in (10292), which is defined as a cluster comprised of worked antler, three young pig mandibles and infantile caprine remains, as well as round pebbles and other stone fragments. The interpretation of this unit was problematic because it had aspects of storage, food consumption and ritual deposition (Bogaard 2008). The high numbers of rodents could be explained not only by the grain stored there but also by the bones found in this feature; these bones could have had residual meat or grease adhering to them which could have attracted mice. It is interesting, however, that this unit has a far greater NISP than the other units associated with this feature. This is in contrast to F.2004, which has a far more even distribution of microfauna throughout the majority of the units, although the presence of amphibians in this feature is also noteworthy.

It is possible that carnivores were tolerated at Çatalhöyük because they helped to keep mice numbers under control. There is evidence that ancient Egyptians kept weasels before they had domesticated cats in order to control the number of rodents in their settlements. In some parts of modern Egypt, weasels are encouraged to occupy houses to such an extent that Osborn & Helmy (1980, 409) claim they are "almost completely commensal". Weasels were also found in the faunal assemblage from Pompeii. Powell (forthcoming) argues that due to the urban nature of the site it would have been an unlikely habitat for wild weasels and suggests that they were kept by the inhabitants of Pompeii and used for pest control. This interpretation is supported by the presence of house mouse and other rodent bones in the assemblage, as well as the discovery of a house mouse pelvis, with puncture marks (Powell forthcoming).

The encouragement of predators into settlements during the Neolithic period is not without precedent. A cat (*Felis silvestris*) burial was found in close proximity to a human at the Neolithic site of Shillourokambos on Cyprus, which was inhabited from the end of the 9th millennium BC to the end of the 8th millennium BC. The excavators argue that cats may have had special status in the Neolithic societies of southwest Asia, and that the burial probably demonstrates evidence for the taming of cats in order to protect stored grain from pests (Vigne *et al.* 2004). A cat (*Felis silvestris*) was also found in a Predynastic burial at Hierakonpolis, Upper Egypt, which has a relative date of approximately 3700 BC. Analysis of the remains revealed healed fractures of the humerus and femur, suggesting that it had been kept in captivity for at least four to six weeks prior to burial. This burial took place almost 2,000 years before the time that domestic cats were thought to have been present in Egypt (Linseele *et al.* 2007, 2081).

As discussed above, the size of the puncture marks on the microfauna suggest that the species of predator was small and, at the time of writing, it is proposed that the predator was a small mustelid such as a weasel or polecat. Weasels are specialized small-mammal hunters, focusing primarily on rodents; voles and mice are the favored prey, comprising 60 to 80 per cent of animals taken. Polecats prey on a wide variety of small mammals including voles, mice, hamsters, rats and rabbits. Weasels and polecats are found in the macrofauna in low numbers, but this does not discount them as possible predators because it is likely that they would not have lived on site. Weasels will live anywhere where this is some form of cover and prey. Polecats live in tunnels and usually claim and renovate tunnels dug by rodents (MacDonald & Barrett 1993). Experiments focused on feeding mice to weasels is the only way to confirm or refute this hypothesis..

## Conclusion

The analysis of the microfaunal assemblage from the second phase of excavations at Çatalhöyük provides us with a greater insight into how the microfauna 'inhabited' the site than was available from earlier assemblages. This assemblage, including as it does, samples from the burnt buildings, B.52 and B.77, allows us a glimpse into the nature of the occupation of these buildings by the microfauna at the time of their destruction. What is apparent from these samples is that, as expected, mice and other microfaunal taxa were attracted to the site and took full advantage of the scavenging opportunities provided by the storage bins. One question which remains unanswered, however, is which species of carnivore was responsible for predating upon the microfauna? It would appear that the only possible way to answer this question is to conduct feeding experiments to determine whether the taphonomic patterns left by the carnivores varies according to the species and size of the microfauna consumed. What is apparent from analyses to date is that the scope and scale of the excavations at Çatalhöyük means that this site is unique in offering us the opportunity to explore how the commensalism of small mammals evolved with sedentism and how the human inhabitants of the site responded to this problem.